

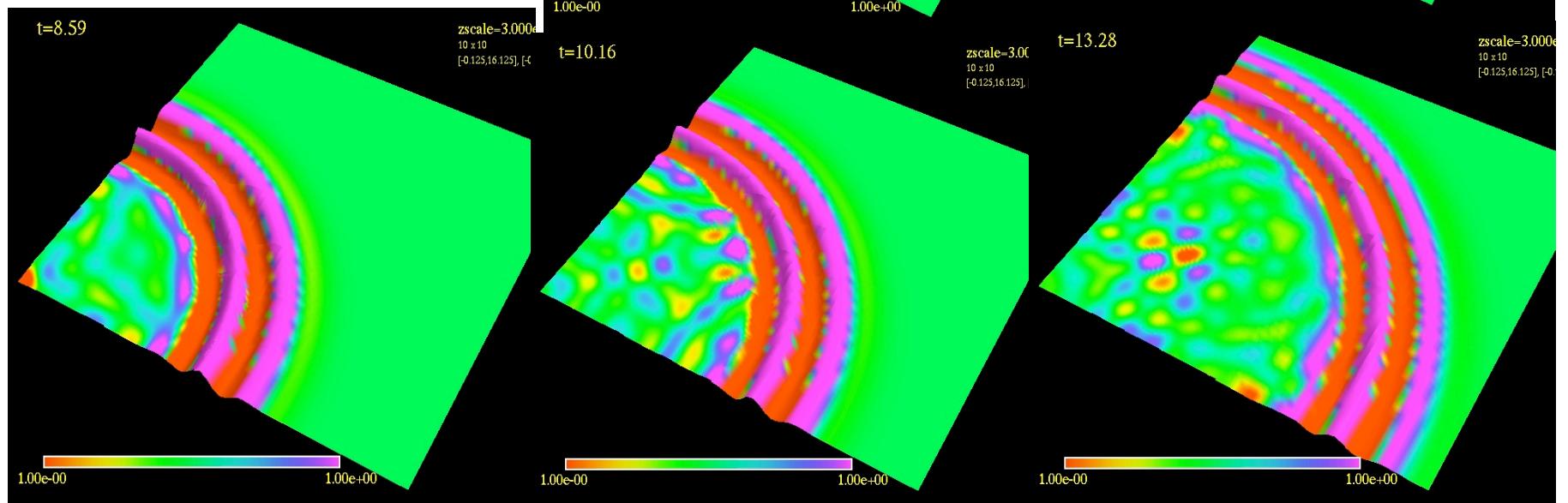


# APPLICATIONS- Gravity waves

## GENERAL RELATIVITY

Solving Einstein's 3D-equations to  
**simulate the evolution of  
gravitational waves:**

(Courtesy of **Dale Choi, John Baker, David Fiske, Breno Imbiriba, James Van Meter, Joan Centrella**- Numerical Relativity Group Code 660, NASA/Goddard), **Robert Brown, Lisa Lowe** (NCSU)





# APPLICATIONS – RHESG

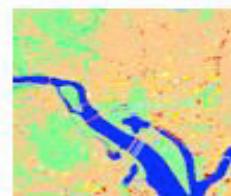
## Recursive Hierarchical Segmentation James C. Tilton, NASA GSFC, Code 935



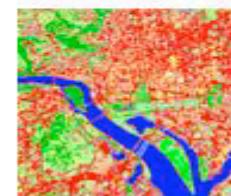
Landsat TM



12 regions



25 regions



50 regions



11 selected regions

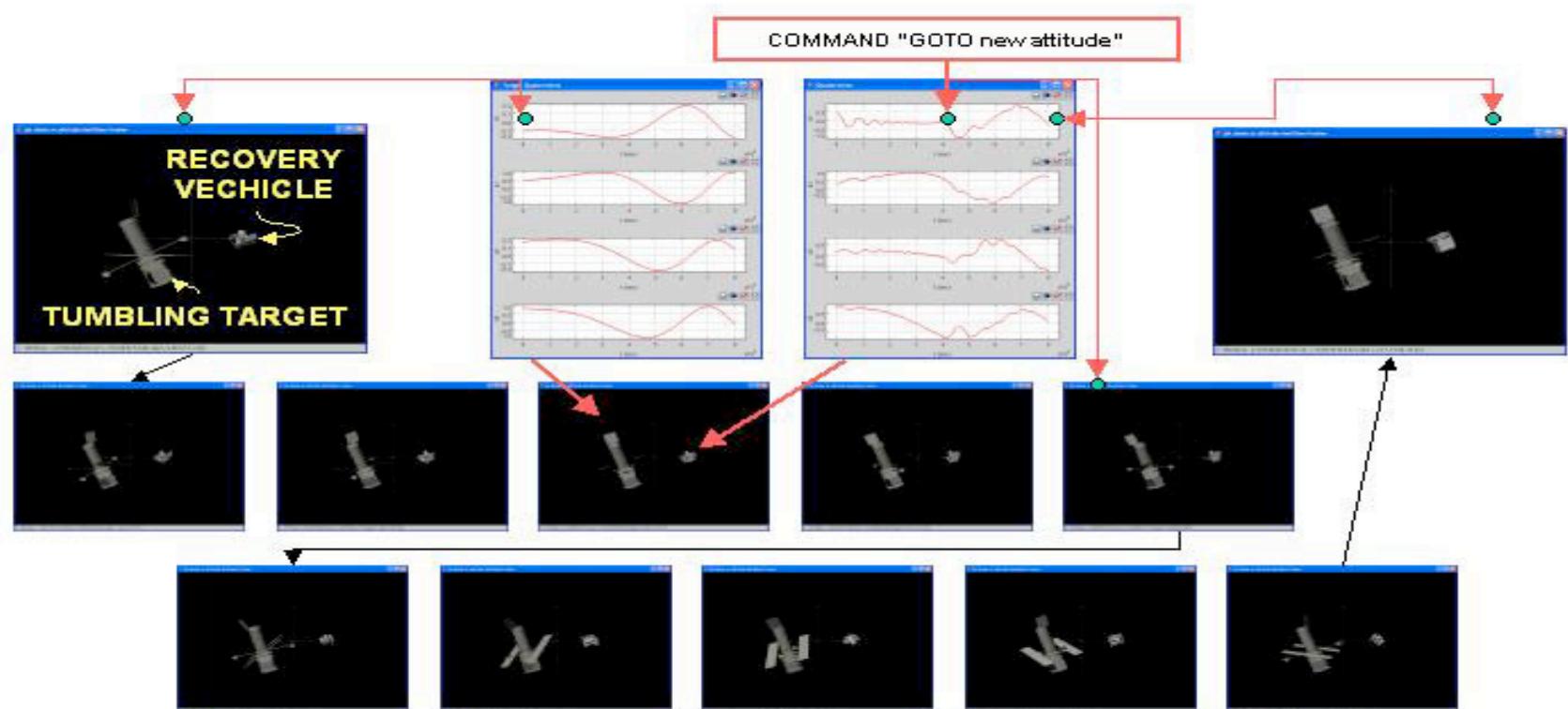
Recursive Hierarchical Segmentation (RHSEG) was used to produce several hierarchically related segmentations of a Landsat TM scene. Three of these segmentations are shown above (12, 25 and 50 regions). The interactive HSEGViewer program was used to select the 11 most important regions from the segmentation hierarchy.

Landsat TM Image Size	Thunderhead # CPUs	Processing Time
6912x6528	256	6 min 54 sec
4096x4096	256	4 min 4 sec
2048x2048	256	1 min 21 sec
1024x1024	256	38 sec
512x512	256	22 sec
1024x1024	64	1min 0 sec
512x512	64	23 sec
256x256	64	14 sec



# APPLICATIONS – Neural Systems

## Synthetic Neural System / Neural Basis Function *Autonomous Change of Relative Attitude with 6 Neurons*



A Synthetic Neural System that autonomously adapts to chaotic behavior or other irregularities in its environment while still pursuing mission objectives is being developed for spacecraft and planetary rover control (prov. NASA patents applications filed).



# APPLICATIONS – Hyperspectral Data and Parallel Matlab

## Parallel Supervised Classification of Hyperspectral Data using the Support Vector Machine Algorithm (SVM)

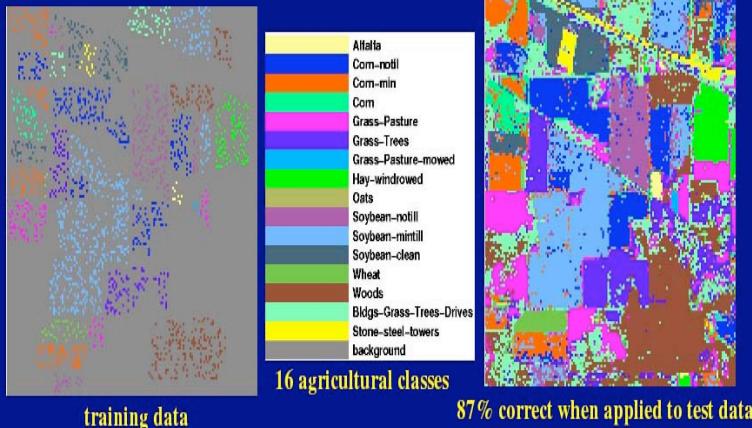
*J. A. Gaultieri, Code 935*

- For hyperspectral data must handle large data volumes.
- SVM very effective for supervised classification of hyperspectral data with many classes.

Example: 168 MB for a small AVIRIS scene 145x145 pixels with 200 bands/pixel and 16 classes, must train 120 classifiers (all class pairs).

Use 120 processors to get 5 x speedup over single processor (5 because limited by slowest training)

To validate: Split ground truth into train/test fraction = 20%/80% for 16 classes get 87% correct on test fraction.



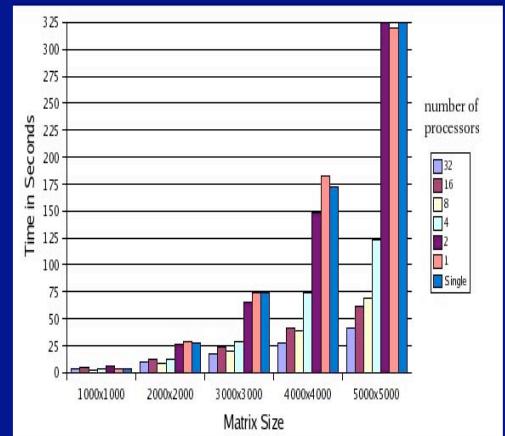
## Matlab\*P: Interactive Supercomputing with Matlab

*J. A. Gaultieri, Code 935*

developed by P. Husband, R. Choy, A. Edelman

On a given number of processors invert a series of random matrices...

```
for i=1:5
    a=rand(i*1000*p);
    b=inverse(a);
end
```



Matlab front end with cluster as back end compute server. Use an existing MPI library on server. Add \*p to Matlab code defining array size, and operators overload automatically.